agriculture
Department:
Agriculture
REPUBLIC OF SOUTH AFRICA

UMLINDI
The Watchman

ISSUE 2009-07 9 JULY 2009

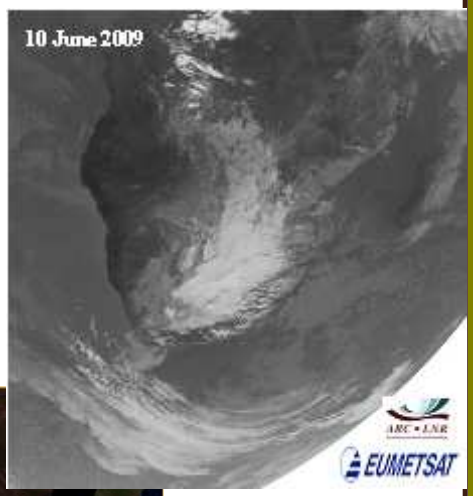
INSTITUTE FOR SOIL, CLIMATE AND WATER

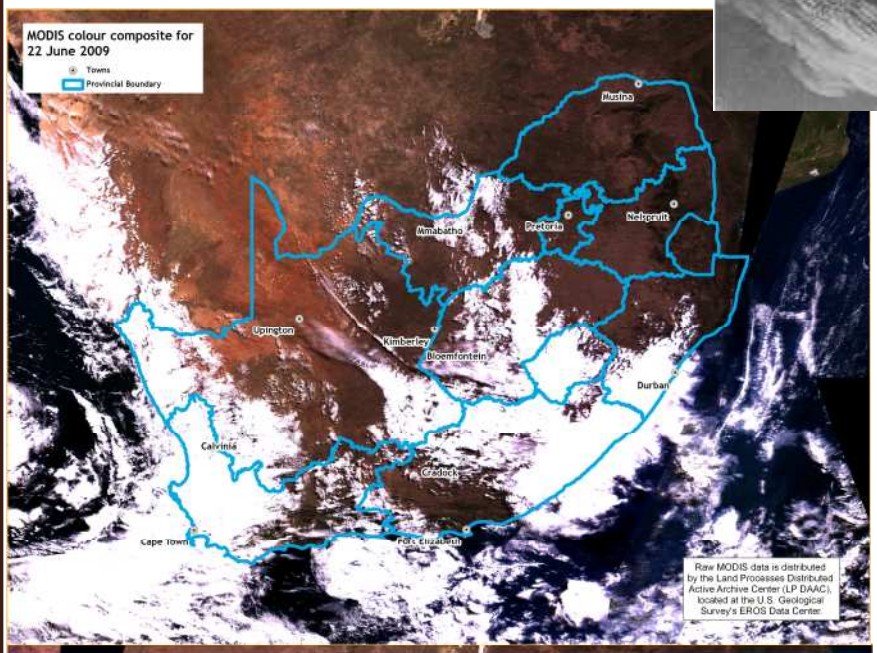
- Latest vegetation conditions as deduced from SPOT VEGETATION
- Rainfall for June 2009

CONTENTS:

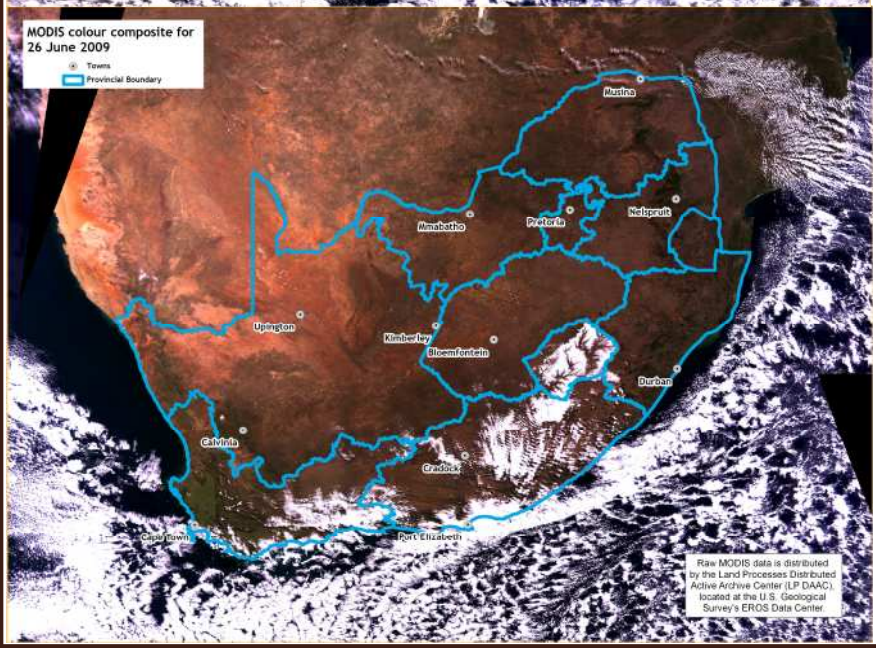
Images of the Month

The thermal image from the MSG satellite on the 10th of June shows a large cloud band that spirals from the tropics on the eastern side around a deep upper air cut-off low pressure system situated over the eastern parts of Namibia. This system was to a large extent responsible for much above-normal rain over the summer rainfall area with unseasonal heavy rain especially over large parts of Botswana. Due to the advection of cold moist air from the south and east on the surface and total cloud cover, maximum temperatures over the interior plummeted. This was accompanied by strong surface winds and general rain. The rain over the summer rainfall area was welcomed by farmers over the central areas where soil moisture was inadequate for winter wheat cultivation.





Upper air troughs caused further rain over the interior, especially during the first 20 days of the month. The MODIS colour composite for the 22nd of June shows one of several cold fronts that moved over the country in quick succession, causing widespread rain and stormy weather over the southern parts and snow over the mountainous areas. Frontal activity, especially during the second half of the month, was responsible for above-normal rain over the winter rainfall areas.



The MODIS colour composite for the 26th of June shows the snow on the mountainous areas in and around Lesotho and clear conditions in the wake of the fronts that moved over the country. Cold conditions occurred with widespread frost until the end of the month.

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Vegetation Conditions

Vegetation Mapping

The Normalised Difference Vegetation Index (NDVI) is computed from the equation:

NDVI=(IR-R)/(IR+R)

where:
IR = Infrared reflectance &
R = Red band

NDVI images describe the vegetation activity. A decadal NDVI image shows the highest possible "greenness" values that have been measured during a 10-day period.

Vegetated areas will generally yield high values because of their relatively high near infrared reflectance and low visible reflectance. For better interpretation and understanding of the NDVI images, a temporal image difference approach for change detection is used.

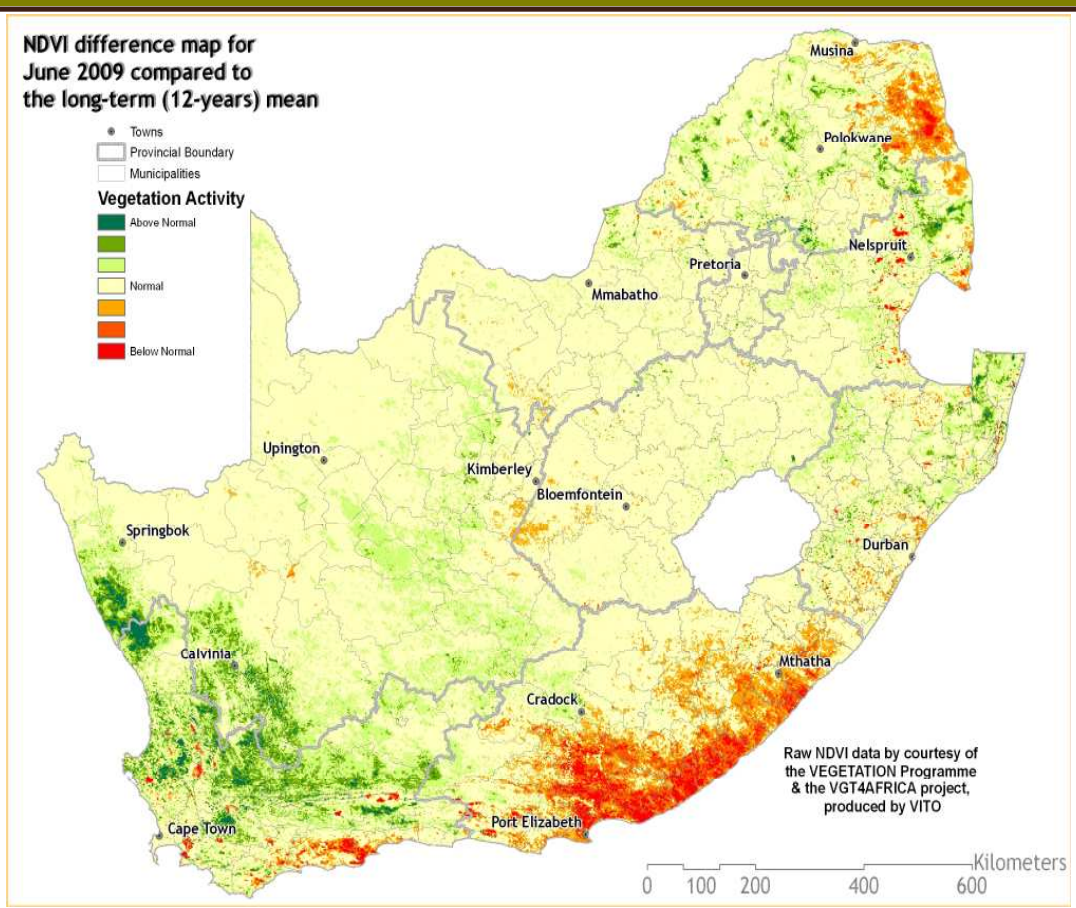


Figure 1

Figure 1:
Vegetation conditions for June were normal throughout most of the country. However, lower vegetation activity can be seen in the Eastern Cape and eastern Limpopo (see also Figures 10-14). Higher vegetation activity can be seen in the Western Cape.

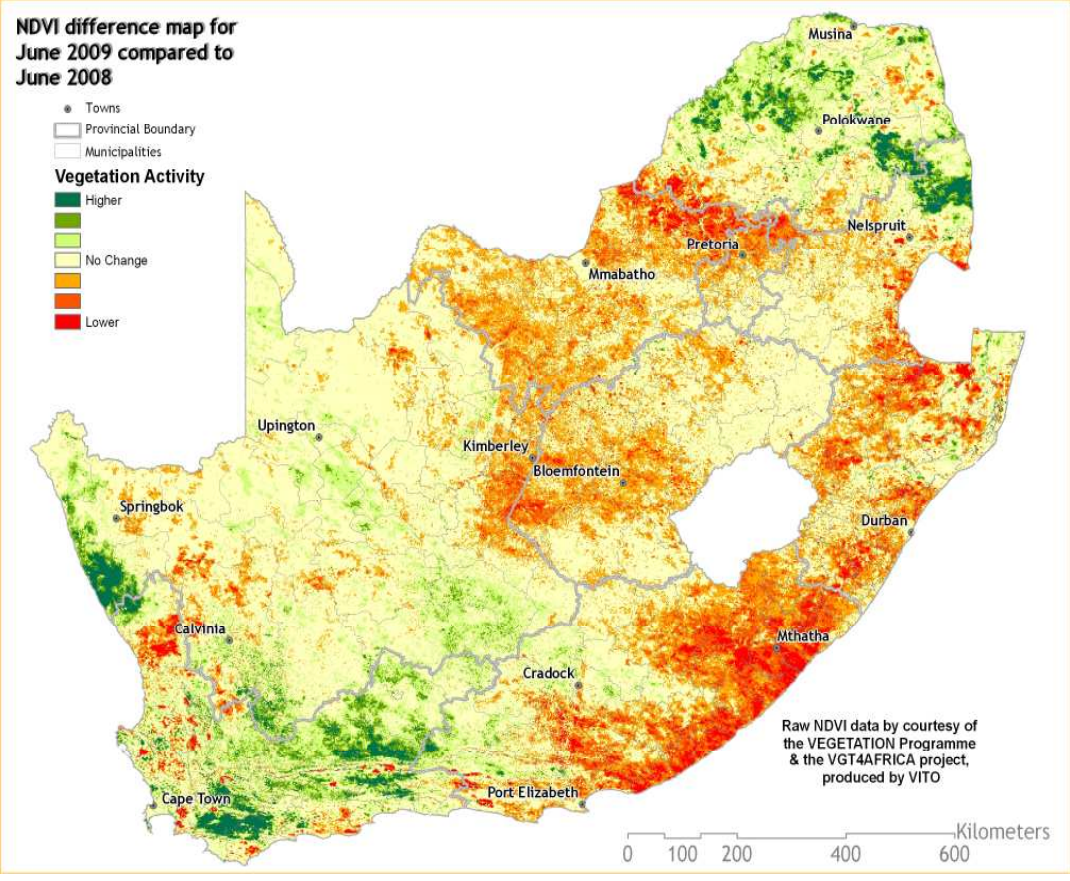


Figure 2

Figure 2:
Vegetation activity for June 2009 is much lower in the summer rainfall region than in June 2008. Large parts of Limpopo received good rain in May and June, and this is reflected in the higher vegetation activity in the province. Higher vegetation activity can be seen in the Western Cape.

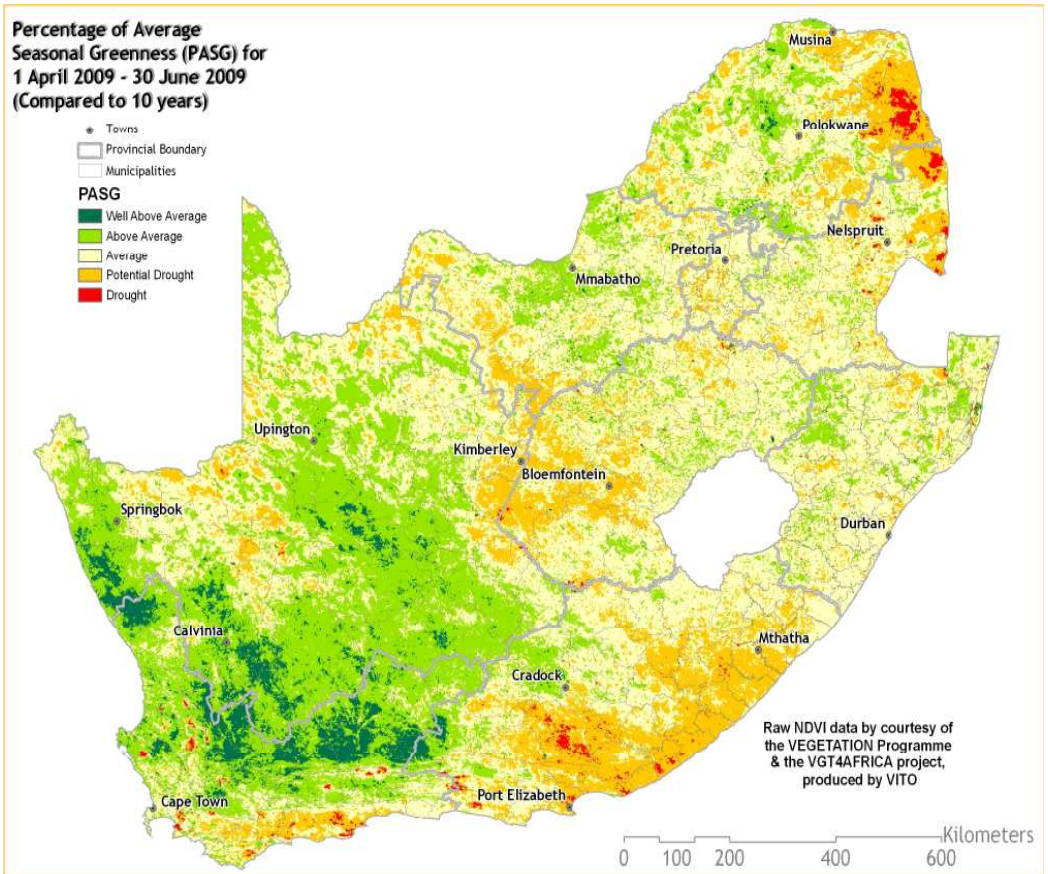


Figure 3

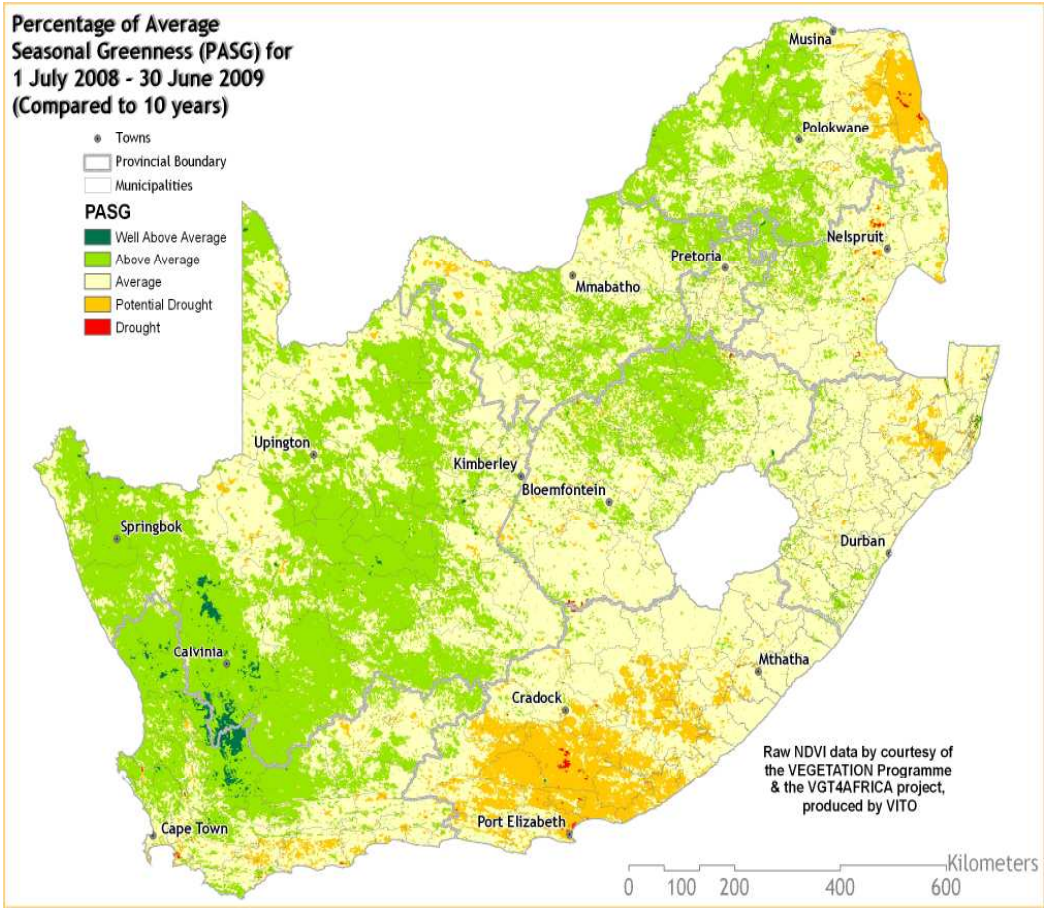


Figure 4

Vegetation Mapping cont.... ***(from p. 2)***

Interpretation of map legend

NDVI values range between 0 and 1. These values are incorporated in the legend of the difference maps, ranging from –1 (lower vegetation activity) to 1 (higher vegetation activity) with 0 indicating normal/the same vegetation activity or no significant difference between the images.

Cumulative NDVI maps: Two cumulative NDVI datasets have been created for drought monitoring purposes:
Winter - January to December
Summer - July to June

Figure 3:
The PASG map for April to June 2009 shows normal to higher vegetation conditions over the western half of South Africa (see also Figures 6-8). Areas of concern, with lower vegetation conditions, include large parts of eastern Limpopo (Figure 12), western Free State, southern region of the Western Cape and the Eastern Cape (Figures 10-11 & 13-14).

Figure 4:
The PASG map for the 2008/09 season shows normal to above-normal vegetation conditions throughout South Africa. The eastern half of the country had a much drier year with lower vegetation activity dominating the Eastern Cape as well as the eastern region of Limpopo.

Vegetation Conditions & Rainfall

NDVI and Rainfall Graphs

Figure 5: Orientation map showing the areas of interest for June 2009. The district colour matches the border of the corresponding graph.

Figures 6-9: Indicate areas with higher cumulative vegetation activity for the last year. These areas are all located over the western parts of the country.

Figures 10-15: Indicate areas with lower cumulative vegetation activity for the last year.

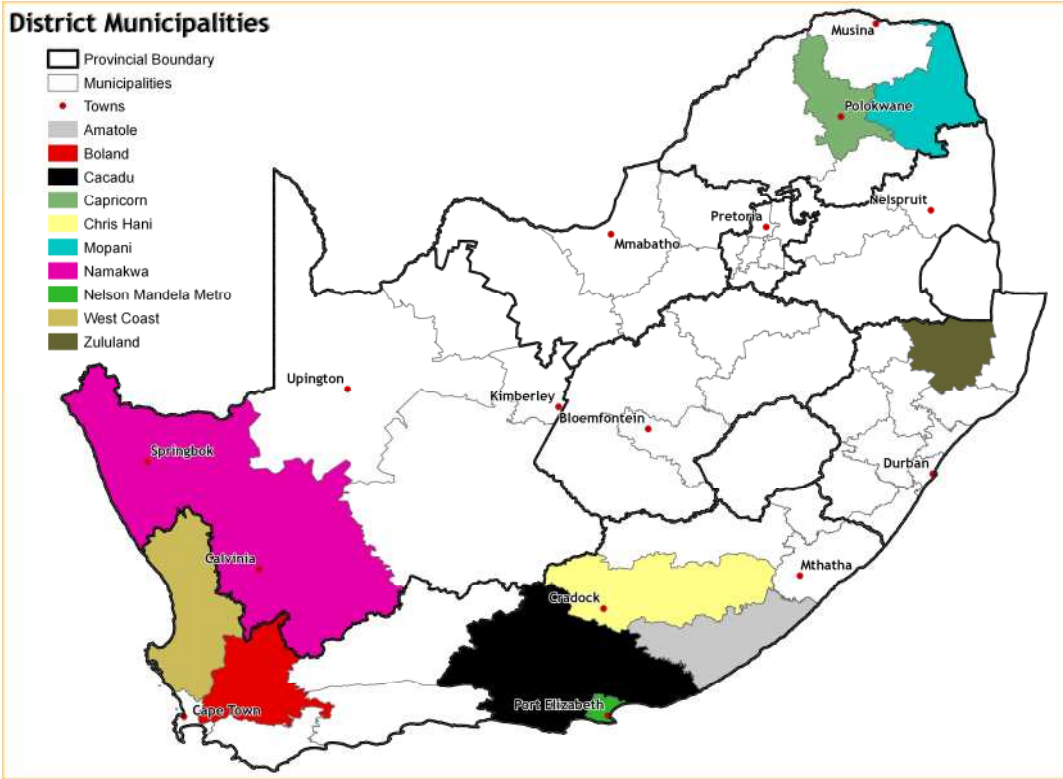


Figure 5

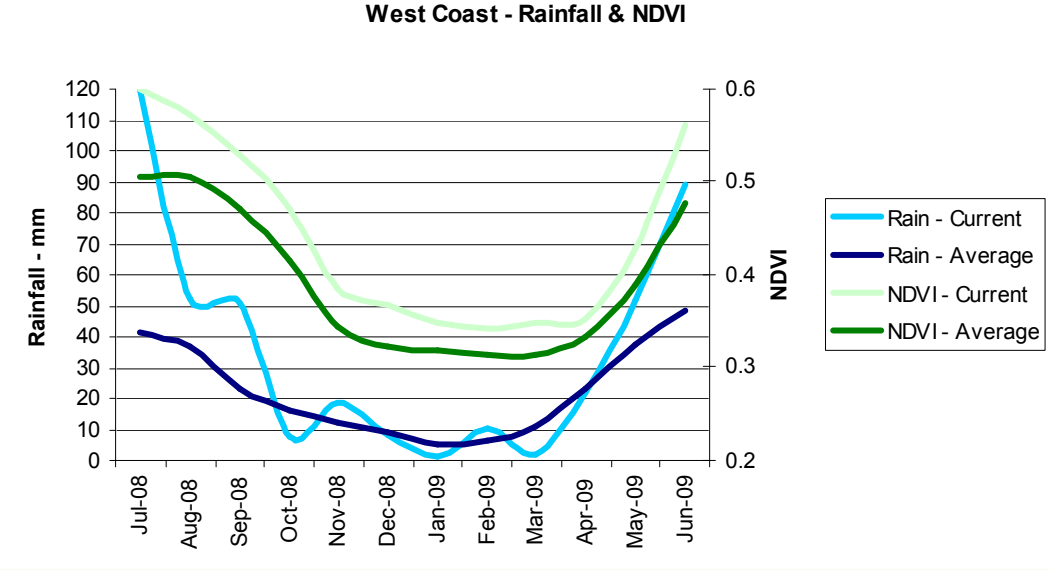
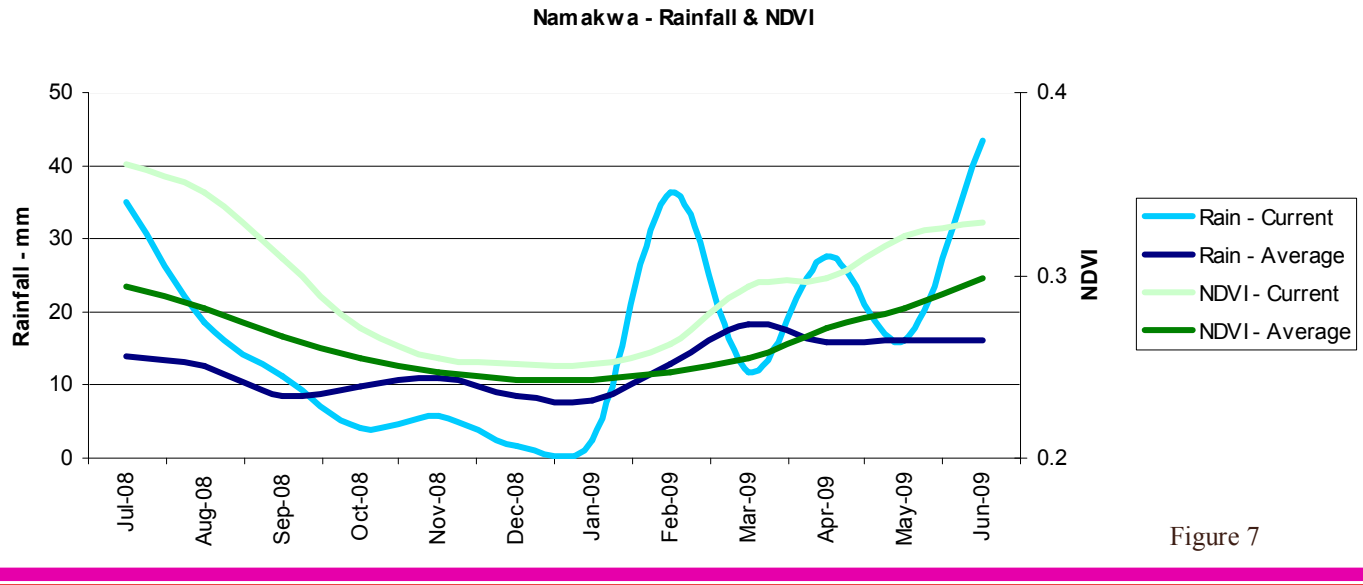


Figure 6



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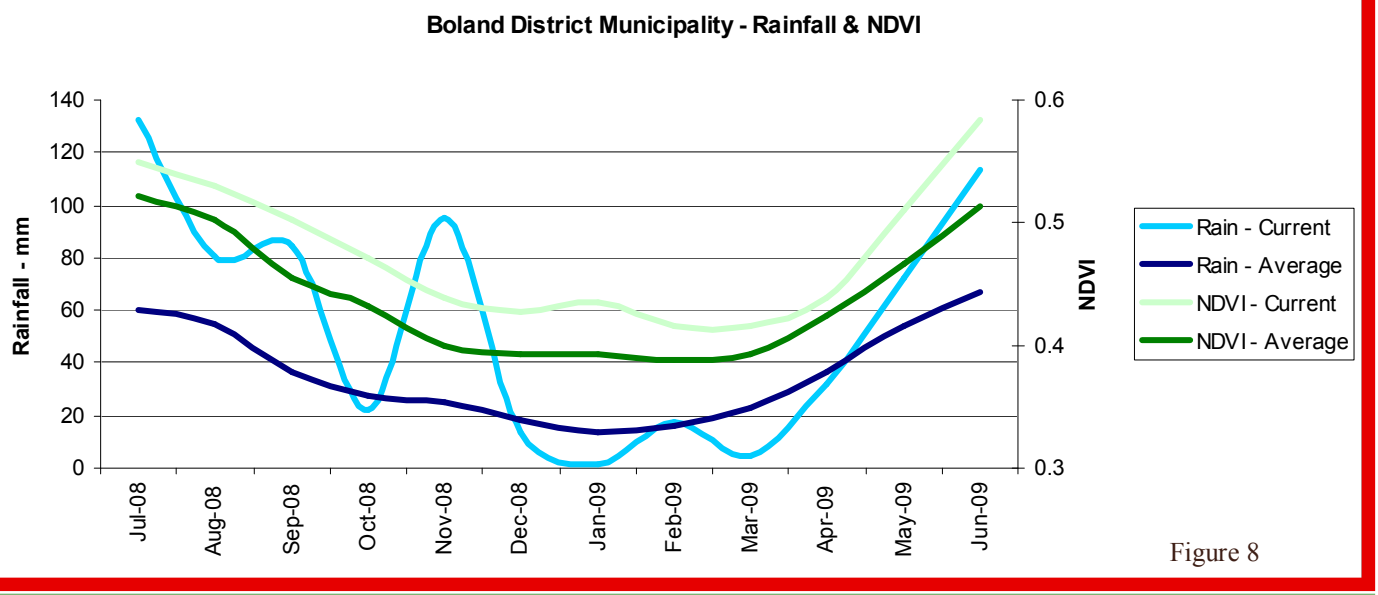

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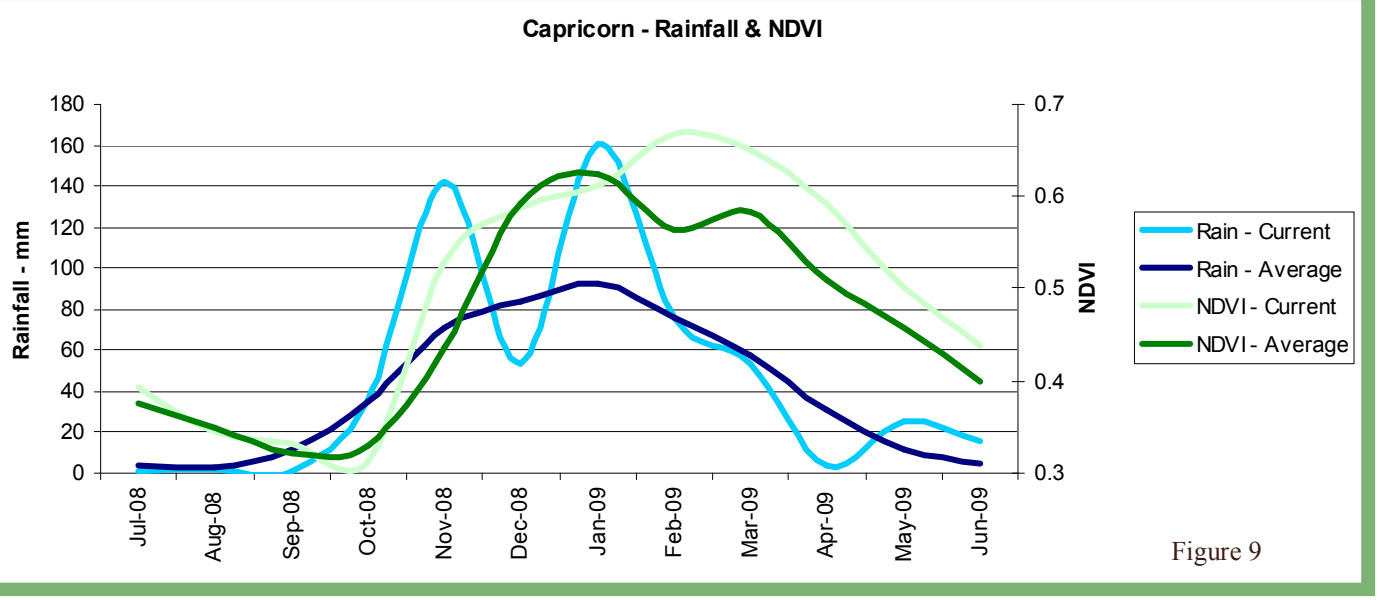

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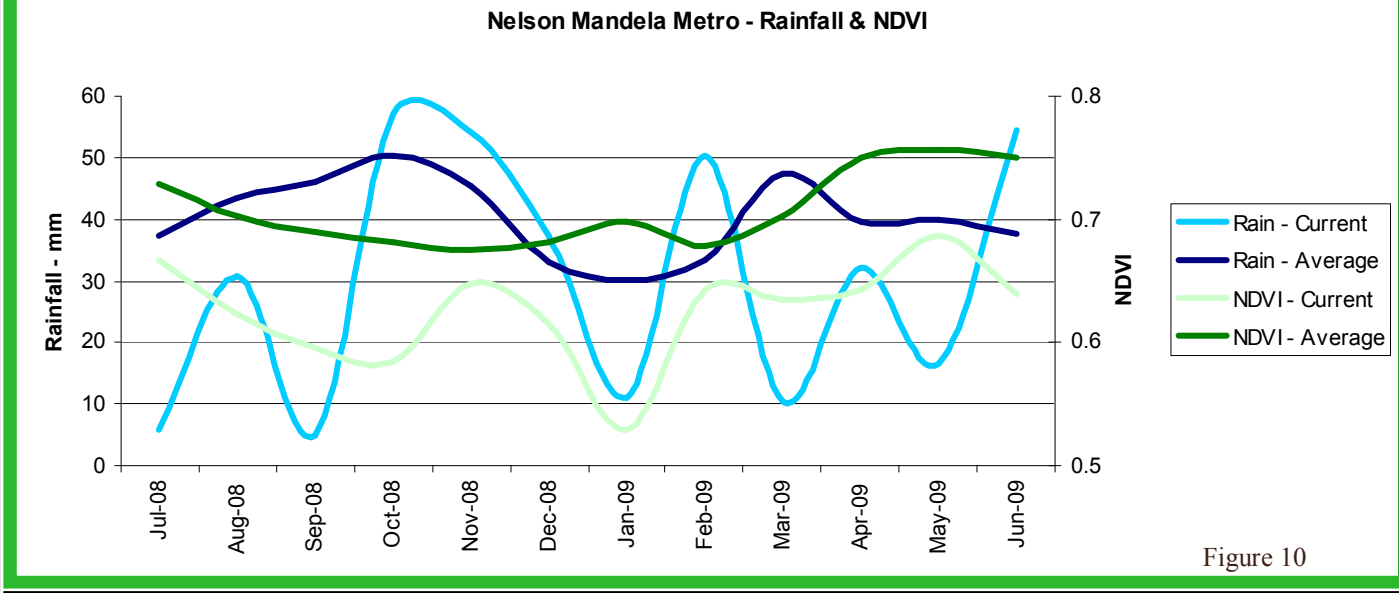
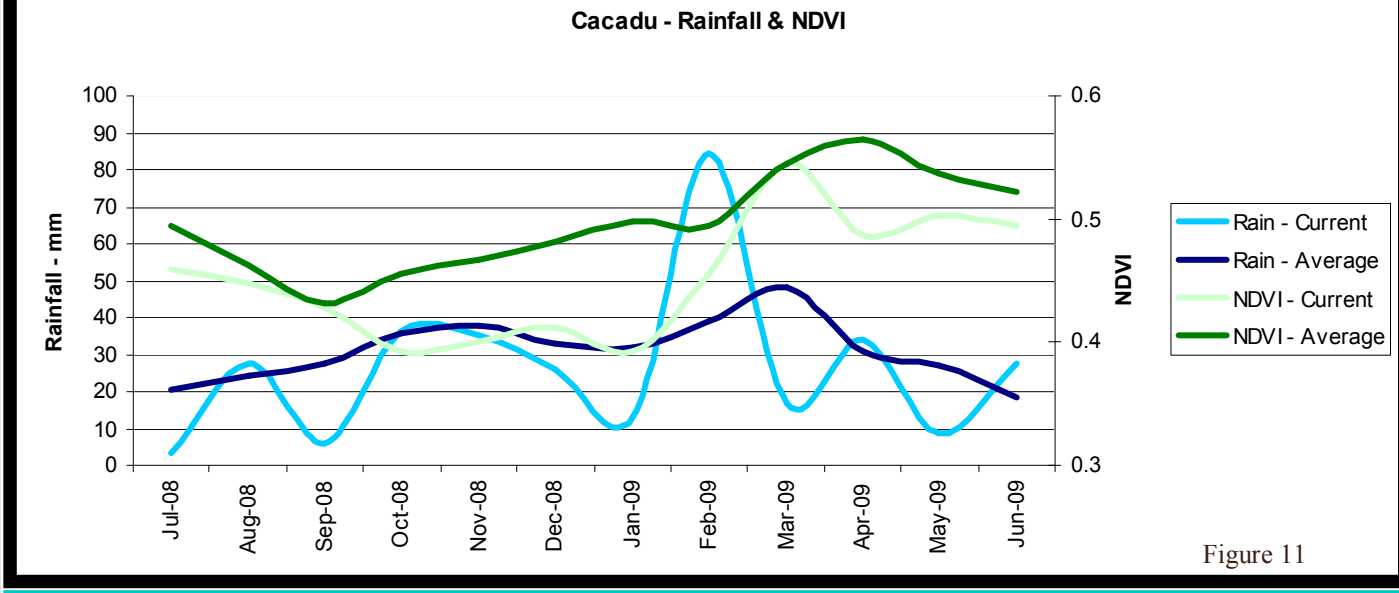


Figure 10



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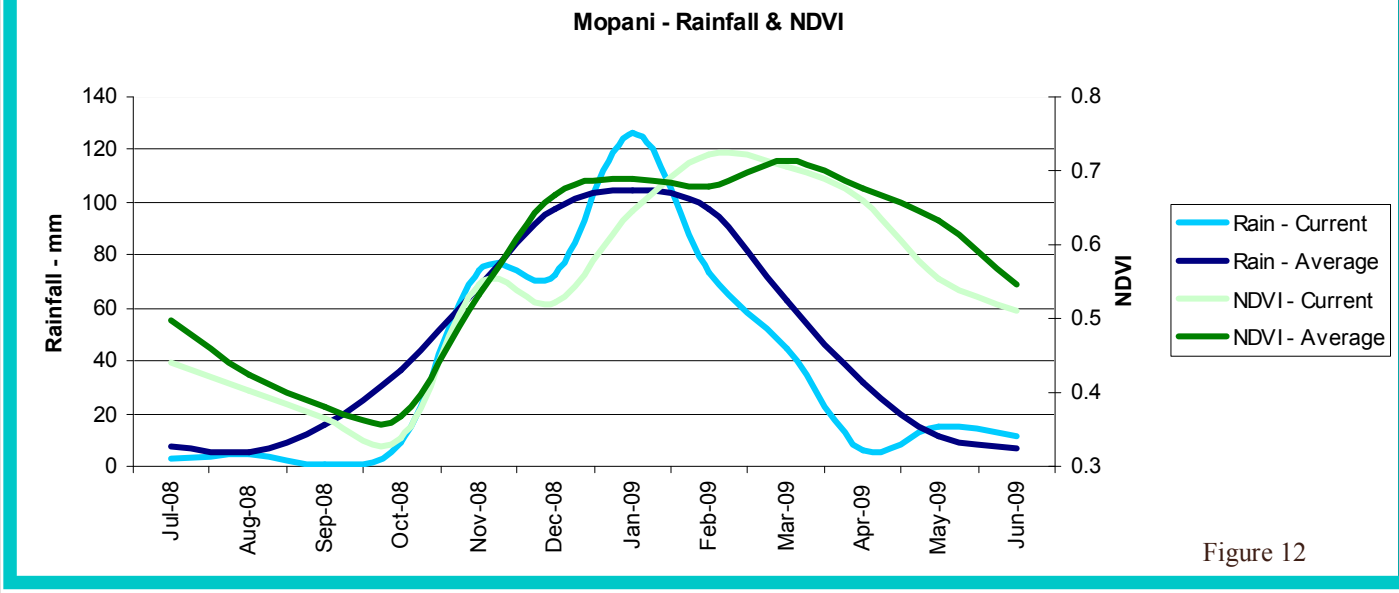

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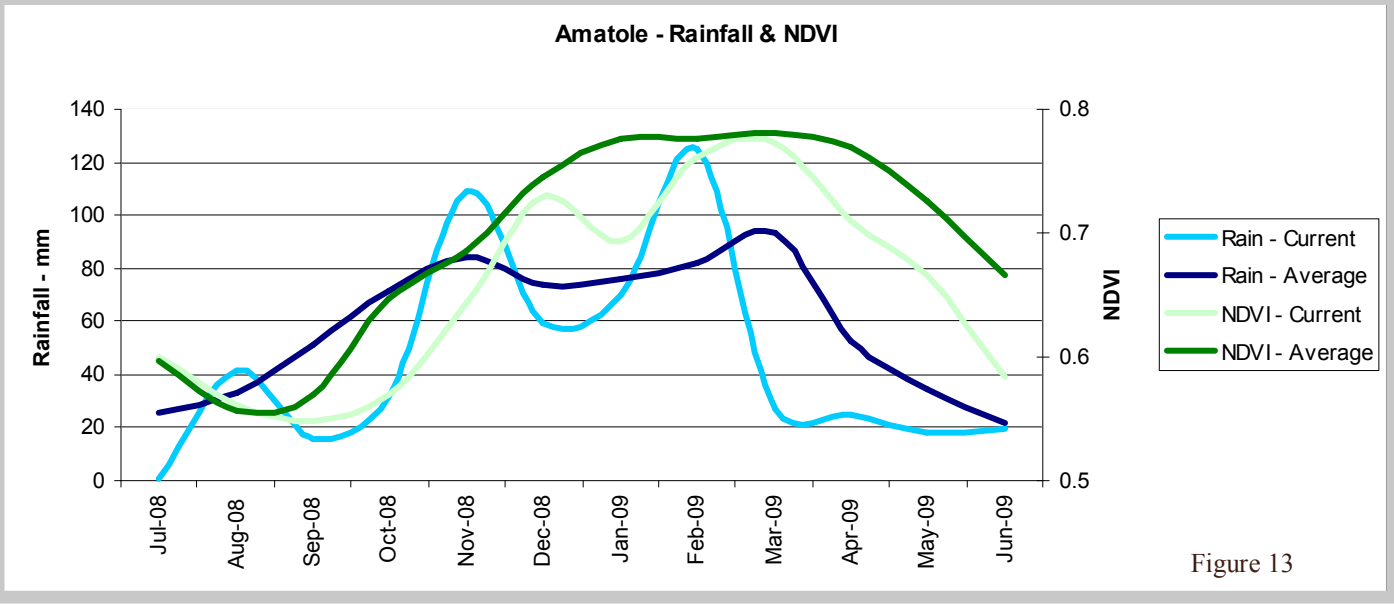

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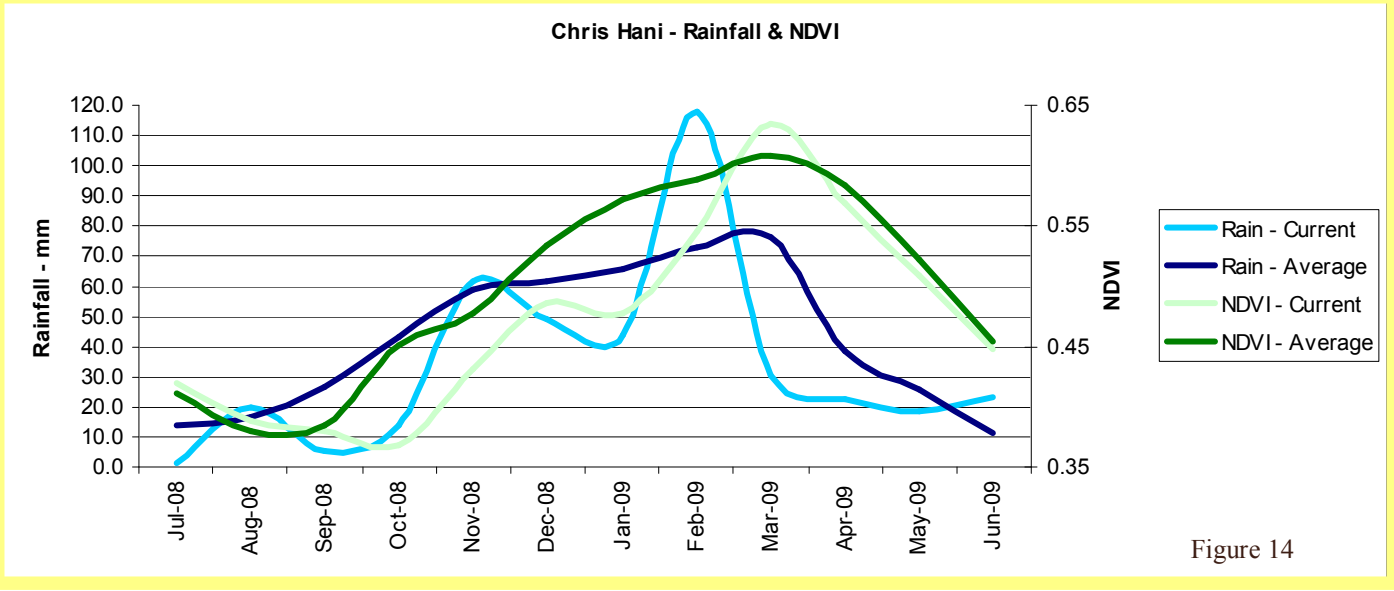

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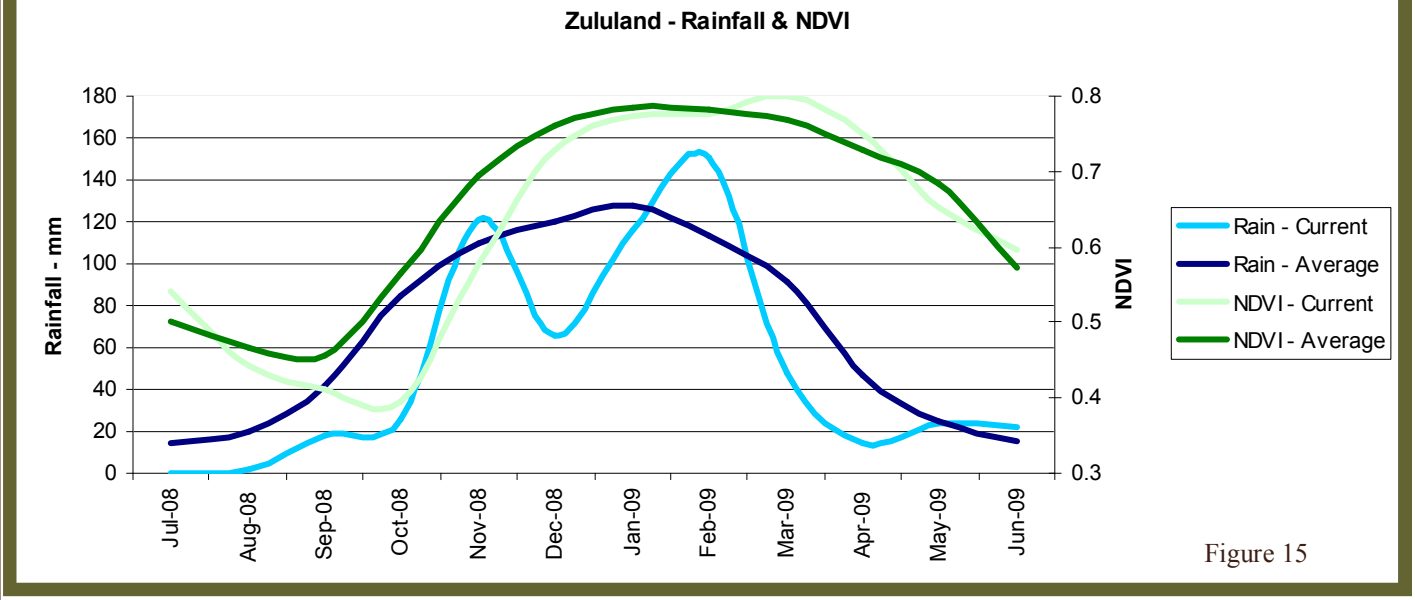


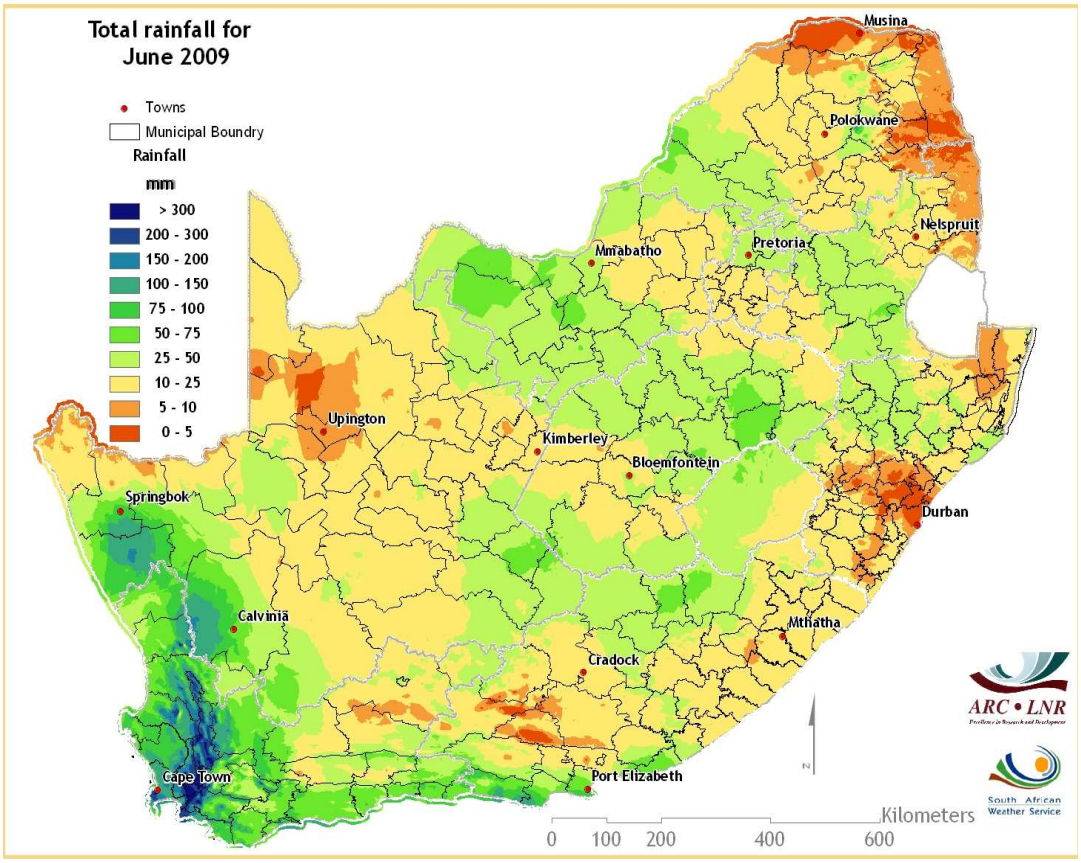
Figure 15

Rainfall

Overview: June 2009

The month started out with lots of high and middle level clouds over the southern parts while frontal systems moved eastward over the far southern areas. Then a strong cold front moved over the winter rainfall area on the 6th. Heavy falls occurred over the winter rainfall areas. A surface high pressure system followed the front and ridged to the south of the country advecting cold moist air over the eastern parts. A deep cut-off low pressure system developed over eastern Namibia on the 9th also causing an inflow of moist tropical air from the north. During the following three days, as the system moved towards the southeast, widespread rain fell over the summer rainfall region in the east with heavy falls in some places. Areas in the central, eastern and northern parts of Botswana, however, received the highest falls. The system was followed by another upper air trough and cold front. While this front once again caused rain over the winter rainfall areas, the trough was responsible for scattered showers over the central interior and later over the eastern parts between the 12th and 19th.

On the 19th, a cold front started to move in over the western parts of the country. It was associated with an upper air trough over the western areas. As the front moved over the country, the trough once again strengthened in the west and further cold fronts moved across with a strong high pressure system to the southwest advecting cold air over the country. Widespread rain and stormy weather occurred over the southern parts with snow on the mountainous areas. Heavy falls once again occurred over the winter rainfall area. Conditions remained cold over the country with widespread frost until the end of the month.



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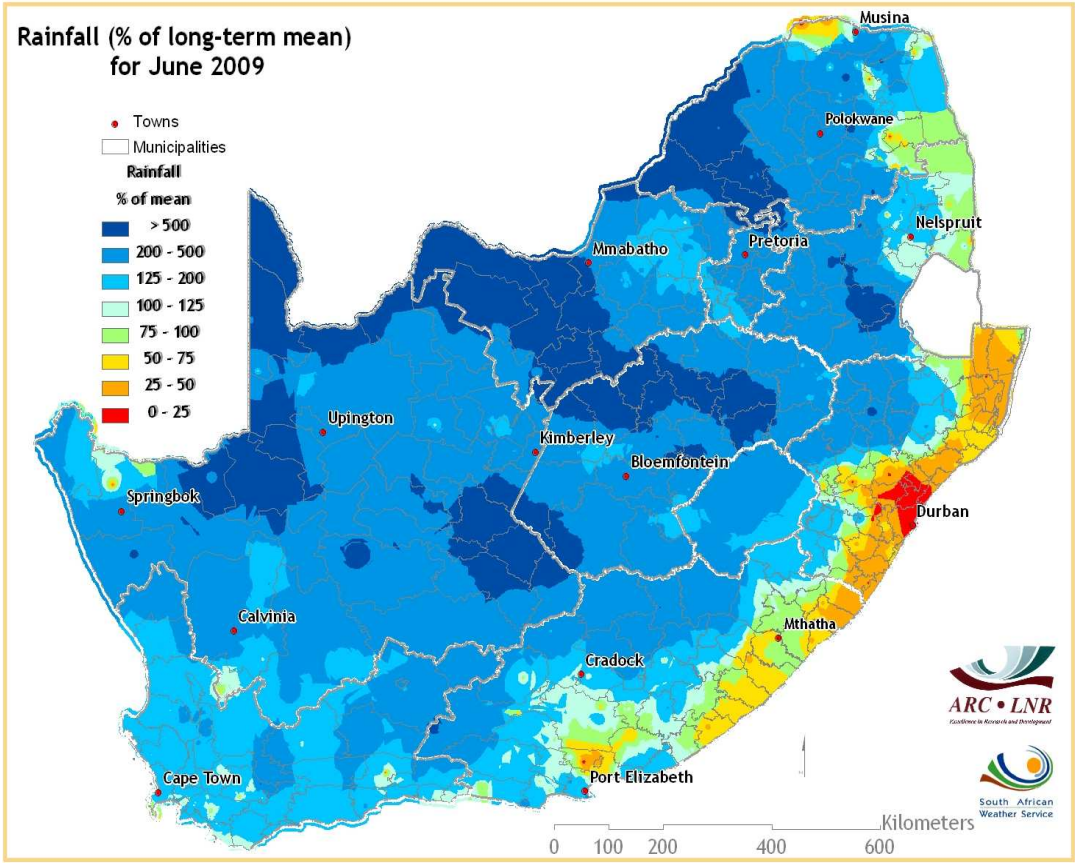

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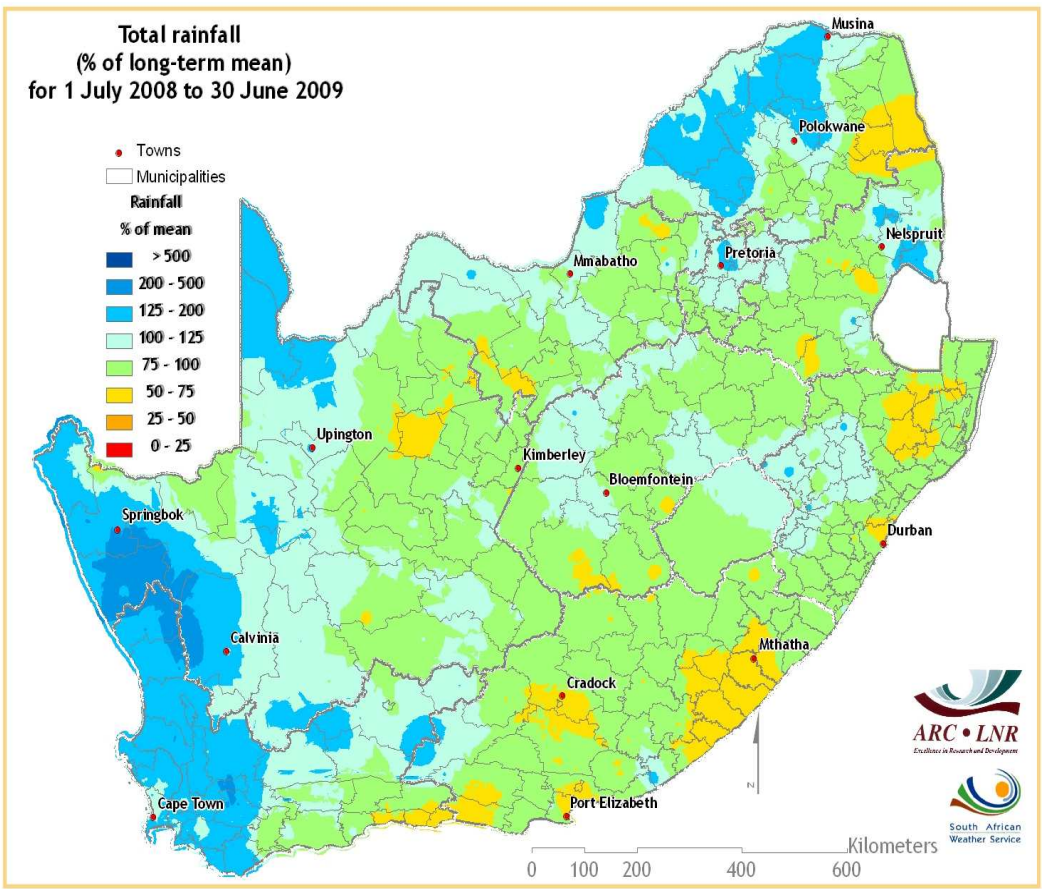

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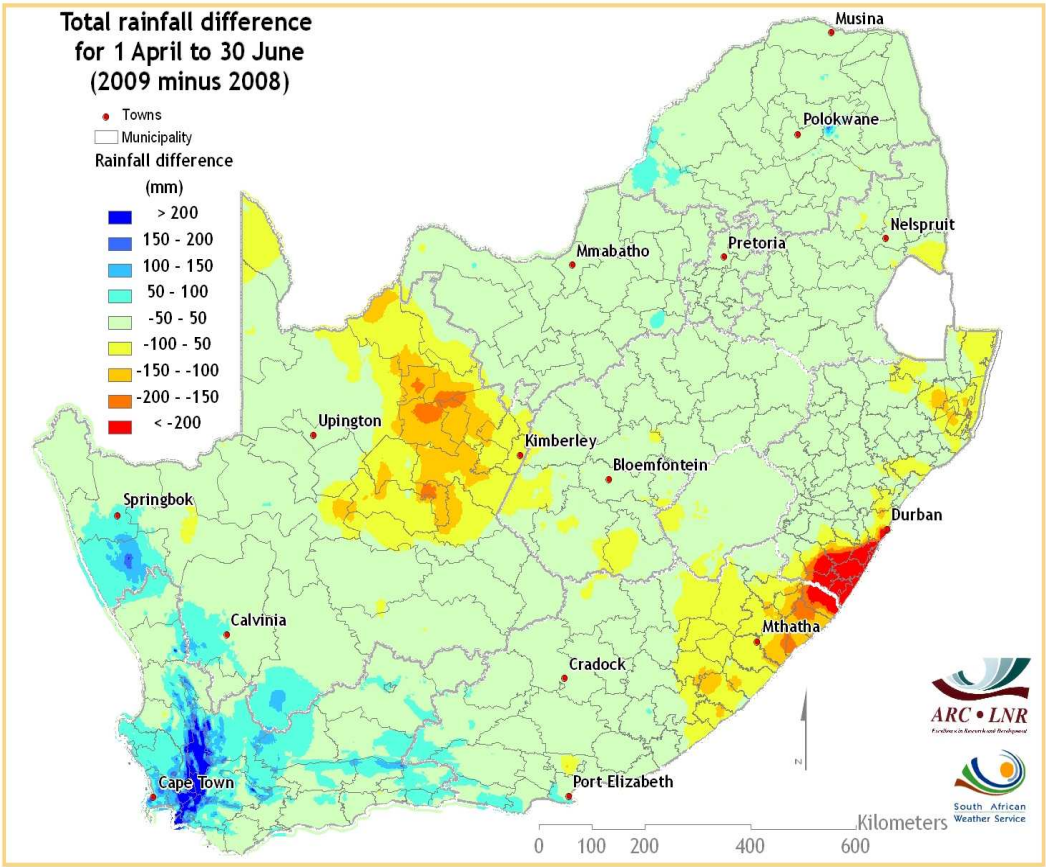


Figure 19

Figures 16 & 17:
Almost the entire country received rain during June 2009. Large parts of the summer rainfall area received more than 25 mm of rain. The highest falls, however, occurred over the winter rainfall area, where large parts received more than 100 mm of rain with in excess of 300 mm over the mountainous areas in the southwest.
The rainfall situation represents above-normal rainfall over most of the country, except the extreme eastern parts. Large areas over the interior received more than 500% of average rainfall for June due to the unseasonable widespread rain over these areas. Rainfall over the winter rainfall area was also above normal.

Figure 18:
For the period July 2008 to June 2009, above-normal rainfall was reported over most of the northern and western parts of the country, while normal to below-normal rainfall occurred over the southeastern and eastern parts as well as over the southwestern Free State and the western parts of the North West Province. Below-normal rainfall occurred especially over the southeastern parts of the Western Cape, parts of the Eastern Cape, northern areas of KwaZulu-Natal and some parts of the Lowveld while rainfall was more than 125% of the average over the western parts of Limpopo, escarpment and surrounding areas of Mpumalanga and the western parts of the Western and Northern Cape provinces.

Figure 19:
When comparing total rainfall for the April to June period between 2009 and 2008, it is clear that the first half of the winter season was accompanied by more rain over the winter rainfall areas, while less rain occurred over a northwest-southeast band stretching from the eastern parts of the Northern Cape to the southern parts of KwaZulu-Natal and the northern parts of the Eastern Cape.

Figure 20:
Rainfall deciles are a statistical classification of rainfall for a specific period into the historical distribution of rainfall for the same period. On the map, a value of 1 refers to the rainfall being as low or lower than experienced in the driest 10%of July to June periods historically (even possibly the lowest on record for some areas), while a value of 10 represents rainfall as high as the value recorded only in the wettest 10% of the same period in the past (or even the highest on record).
Areas where rainfall was in the first decile are the southeastern parts of the Western Cape (where drought conditions have been reported) and northern parts of KwaZulu-Natal. Most of the Eastern Cape, southern parts of the Free State, eastern and northern parts of KwaZulu-Natal, southern parts of Mpumalanga and the far eastern parts of Limpopo received rainfall equal to or less than the third decile. Deciles higher than 8 occurred over western parts of Limpopo and also over western parts of the Northern Cape and Western Cape provinces. In fact, a decile value of 10 occurred over large parts of the winter rainfall area.

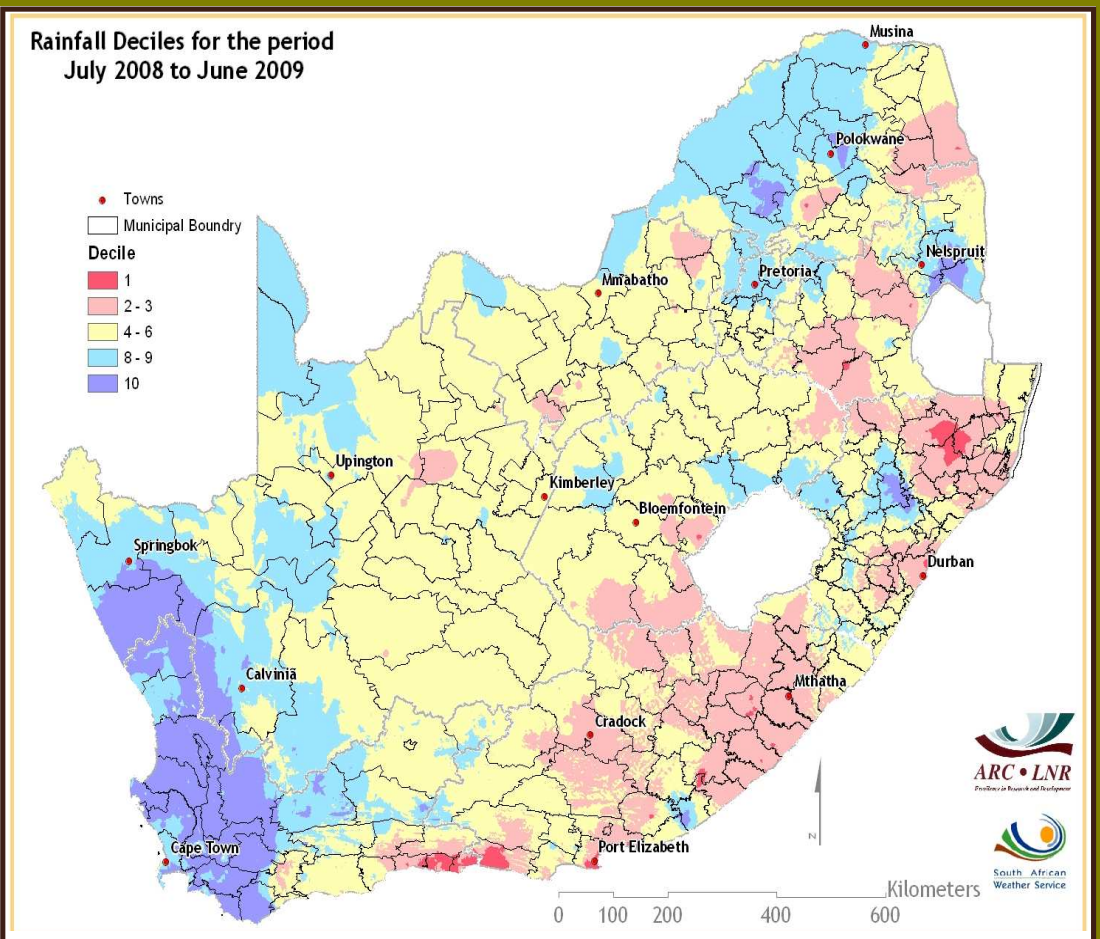
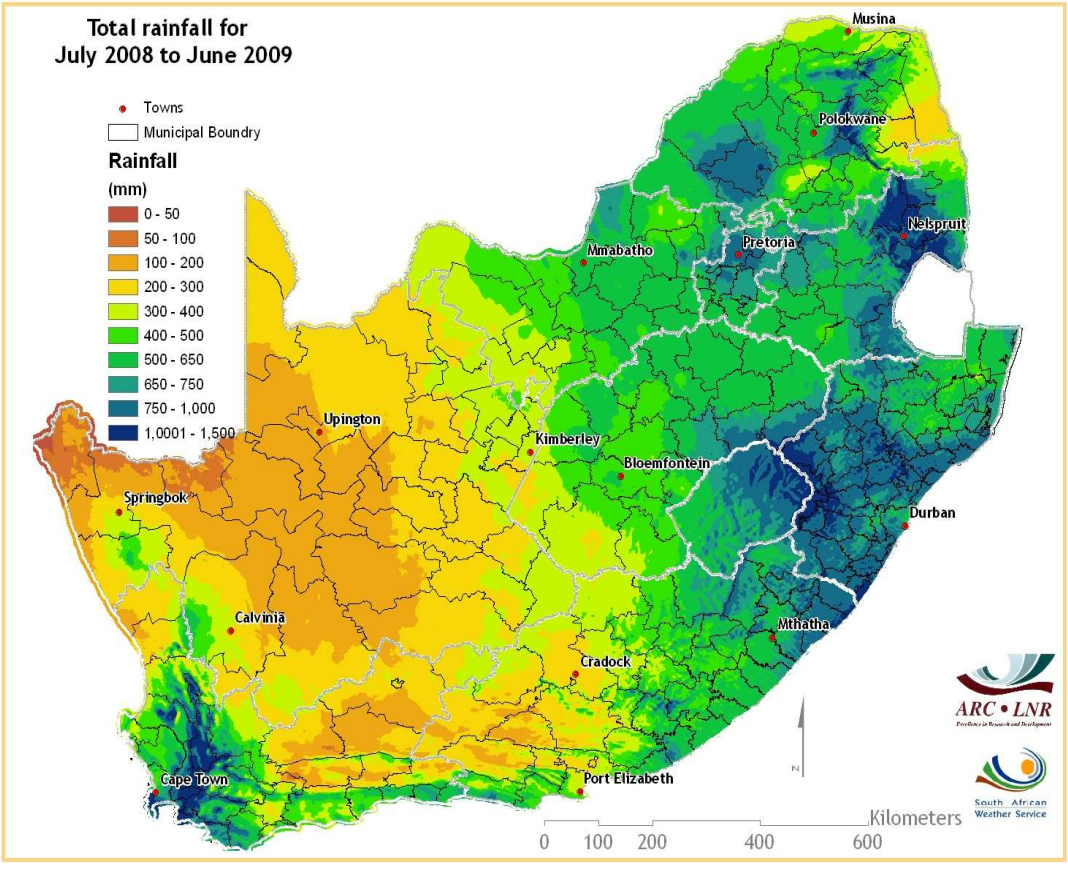


Figure 20



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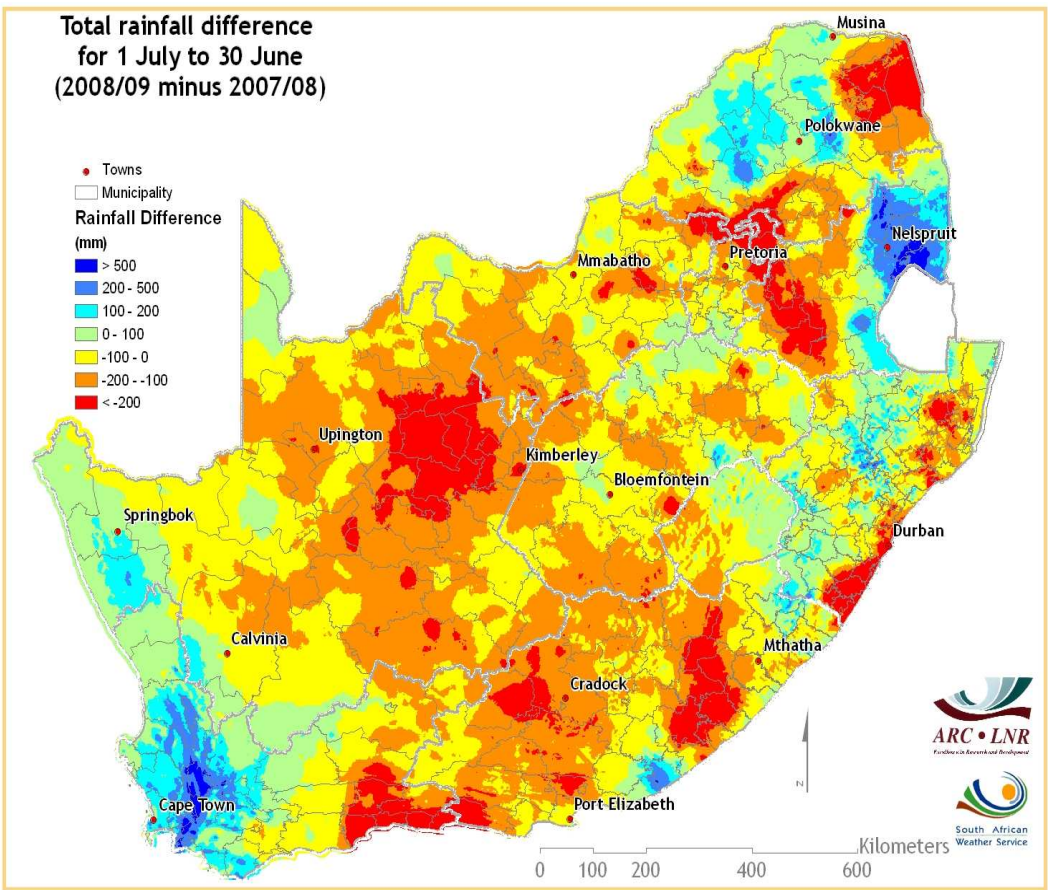

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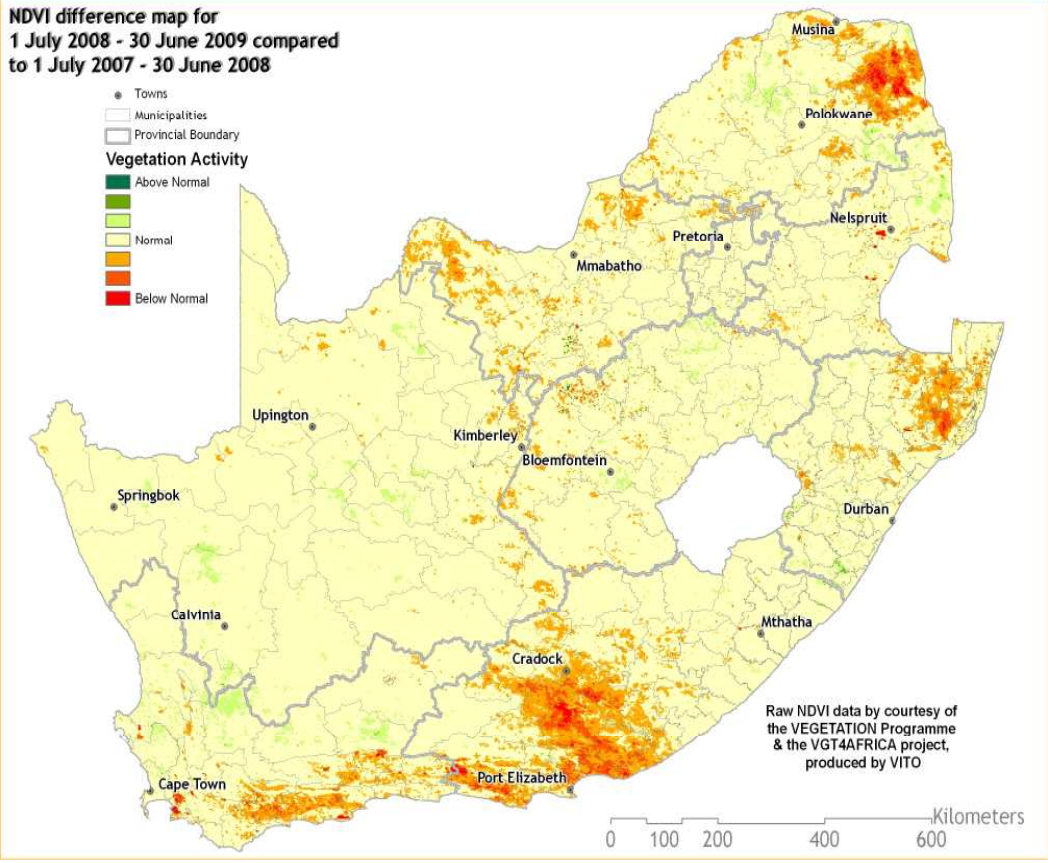

Figure 23

Figure 21:
Over this 12-month period which is the full summer rainfall season, the long-term patterns dominate the rainfall distribution. The highest totals during this period were recorded over the eastern escarpment and the mountainous winter rainfall areas in the southwest. More than 1 500 mm were recorded over these areas. Most of the summer rainfall area in the east received more than 500 mm of rain during this period. Large parts of KwaZulu-Natal, northern Gauteng, eastern Mpumalanga and the Waterberg plateau of Limpopo received more than 750 mm. The lowest rainfall totals (less than 50 mm) were recorded over the dry northwestern parts of the Northern Cape.

Figures 22 & 23:
Compared to the previous summer season, most of the summer rainfall areas received less rain during this season. It must be remembered that above-normal rainfall occurred over most of the summer rainfall area from very early in the 2007/08 season and carried through to the end of the season, while above-normal rainfall during the 2008/09 summer rainfall season occurred mostly during November and the second half of the season (from January onwards). Only western parts of Limpopo, eastern parts of Mpumalanga and western parts of KwaZulu-Natal received more rain than during the previous summer rainfall season. During the same time, most of the winter rainfall region received more rain than during the previous 12-month period.

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Agrometeorology

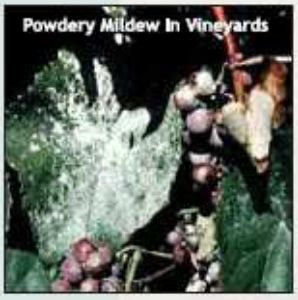
The AgroMet Division of ARC-ISCW conducts and implements research in the field of Agrometeorology and Climatology to promote sustainable utilization of the region's climate, soil and water resources.

Since 1940, ARC-ISCW AgroMet has installed a countrywide network of weather stations aimed at satisfying the climatological requirements of Agriculture in particular. This network has grown to the stage where there are now 110 mechanical weather stations and 455 automatic weather stations.

Since 1940, ARC-ISCW AgroMet has collected all the available climate information from its own climate monitoring network as well as from other organizations such as the South African Weather Service. This collection has now grown to ± 10 000 data points in the climate databank.

ARC-ISCW AgroMet is involved in the following activities:

- **Climate Monitoring (Weather Station Network), Data Management and Dissemination**
  - *Sending out reports, including Disease Warnings, Indices and Daily Data Reports*
  - *Disease warnings include: Powdery Mildew and Downy Mildew warnings*
  - *Indices calculated are: Evapotranspiration, Chill Units, Heat Units and other Temperature Thresholds*
  - *Elements include: Rainfall, Air Temperature, Sunshine Duration, Solar Radiation, Relative Humidity, Evaporation, Wind Speed and Wind Direction*
- **Climate Analysis for Agricultural Purposes**
- **Crop Micro- and Meso-Climate Monitoring**
- **Crop-Climate Matching**
  - *Crop Suitability Surfaces*
- **Crop Growth Modeling**
- **Developing new Climatic Related Early Warning Systems**
- **Spatial Interpolation of Climate Elements**
  - *Long-term Climate Surfaces*
  - *Climate Monitoring*
- **Climate Classification according the Köppen Climate Zones**



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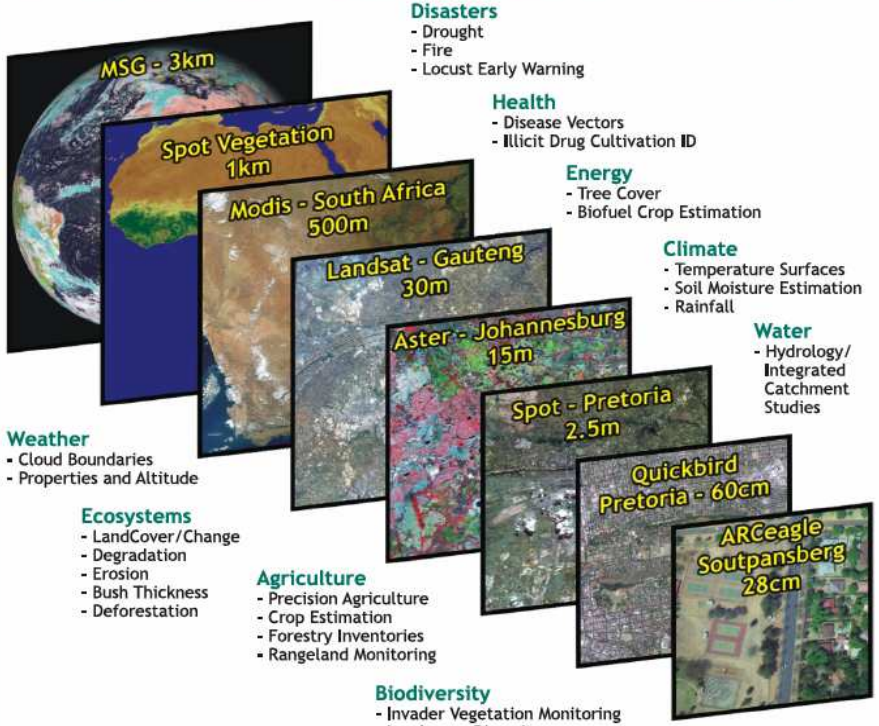

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- Locust Early Warning

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- Illicit Drug Cultivation ID

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- Biofuel Crop Estimation

Climate
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- Rainfall

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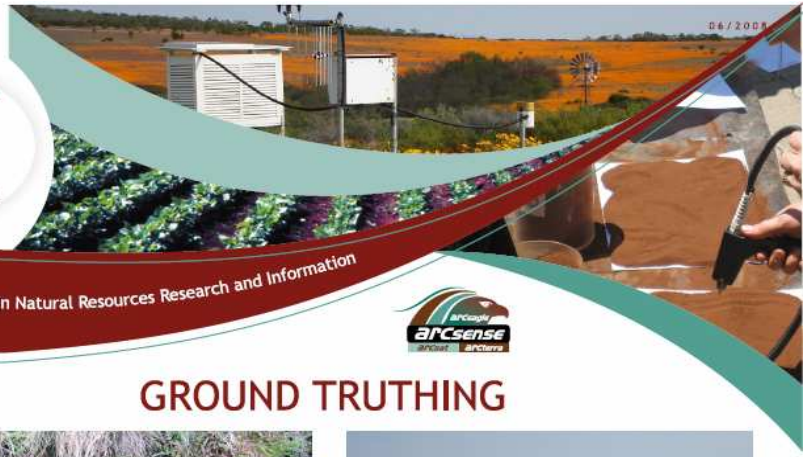

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The Coarse Resolution Imagery Database (CRID)

NOAA AVHRR

The ARC-ISCW has an archive of daily NOAA AVHRR data dating from 1985 to 2004. This database includes all 5 bands as well as the Normalised Difference Vegetation Index (NDVI), Active Fire and Land Surface Temperature (LST) images. The NOAA data are used, for example, for crop production and grazing capacity estimation.

MODIS

MODIS data is distributed by the Land Processes Distributed Active Archive Center (LP DAAC), located at the U.S. Geological Survey's EROS Data Center. The MODIS sensor is more advanced than NOAA with regard to its high spatial (250 m^2 to 1 km^2) and spectral resolution. The ARC-ISCW has an archive of MODIS (version 4 and 5) data.

- MODIS V4 from 2000 to 2006
- MODIS V5 from 2000 to present

Datasets include:

- MOD09 (Surface Reflectance)
- MOD11 (Land Surface Temperature)
- MOD13 (Vegetation Products)
- MOD14 (Active Fire)
- MOD15 (Leaf Area Index & Fraction of Photosynthetically Active Radiation
- MOD17 (Gross Primary Productivity)
- MCD43 (Albedo & Nadir Reflectance)
- MCD45 (Burn Scar)

Coverage for version 5 includes South Africa, Namibia, Botswana, Zimbabwe and Mozambique.
More information:
http://modis.gsfc.nasa.gov

VGT4AFRICA and GEOSUCCESS

SPOT NDVI data is provided courtesy of the VEGETATION Programme and the VGT4AFRICA project. The European Commission jointly developed the VEGETATION Programme. The VGT4AFRICA project disseminates VEGETATION products in Africa through EUMETCast. ARC-ISCW has an archive of VEGETATION data dating from 1998 to the present. Other products distributed through VGT4AFRICA and GEOSUCCESS include Net Primary Productivity, Normalised Difference Wetness Index and Dry Matter Productivity data.

Meteosat Second Generation (MSG)

The ARC-ISCW has an operational MSG receiving station. Data from April 2005 to the present have been archived. MSG produces data with a 15-minute temporal resolution for the entire African continent. Over South Africa the spatial resolution of the data is in the order of 3 km. The ARC-ISCW investigated the potential for the development of products for application in agriculture. NDVI, LST and cloud cover products were some of the initial products derived from the MSG SEVIRI data. Other products derived from MSG used weather station data, including air temperature, humidity and solar radiation.

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The operational Coarse Resolution Imagery Database (CRID) project of ARC-ISCW is funded by the National Department of Agriculture. Development of the monitoring system was made possible through LEAD funding from the Department of Science and Technology.

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Adri Theron – 012 310 2518, iscwinfo@arc.agric.za

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What does Umlindi mean?
UMLINDI is the Zulu word for "the watchman".

http://www.agis.agric.za